Glasshouses and limiting factors

Student activity • observation and reasoning

YEAR 10 / LESSON 32 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

When will changing a glasshouse condition improve yield?

Use the supplied examples, record your reasoning and correct it using evidence.

Equipment

- Student booklet, paper models, pencil and ruler

Paper, modelling and written reasoning only. No chemicals or biological samples are handled.

Course coverage: Shared Biology / Double Award: 5.1–5.2. Protected cropping.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

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1. Draw a glasshouse and identify how it can alter temperature, water supply, carbon dioxide and light compared with outdoors.

2. Use a limiting-factor model: extra carbon dioxide has little effect when light is too low; extra light may have little effect when another requirement is limiting.

3. Analyse the illustrative scenario: treatment A yields 8 kg at a cost of 4 units; B yields 10 kg at 7 units; produce sells for 2 units per kg. Calculate income minus the stated cost.

4. Explain why warmer is not always better: enzyme function, plant water loss and other stresses can limit growth.

5. Propose a controlled crop trial with replicate plants and consistent variety, starting size, time and measurement of marketable yield.

6. Evaluate financial and environmental trade-offs without assuming the highest physical yield is always the best overall outcome.

Cleanup

- Return models and keep the corrected work.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Illustrative scenario only: A = 8 kg, stated cost 4 units; B = 10 kg, cost 7 units; sale price 2 units kg^{-1}. These simplified values omit many business costs. Glasshouses can control conditions but temperature and carbon dioxide effects depend on the current limiting factors.

Example / trial	Observation / evidence	Explanation / limit
Limiting-factor explanation		
Cost and yield calculation		
Fair test / trade-off		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Why might a glasshouse increase yield?

2. Why can carbon dioxide enrichment have little effect in dim light?

3. Calculate the simplified return for A.

4. Calculate it for B.

5. Why does this not prove B is best in a real business?

6. Name three controls in a plant-growth comparison.